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(54) IMPROVEMENTS IN OR RELATING TO DATA PROCESSING SYSTEMS

(71) We, SIEMENS AKTIENGESELLSCHAFT, a German Company, of Berlin and Munich, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to data processing systems and in particular to data processing systems suitable for use as telephone exchange systems.

Data processing systems are known which are constructed from a plurality of calculating units, storage units and input/output control units, which cooperate with one another. In these systems the cooperation is coordinated by an automatic control system in which the work distribution is effected on a priority basis, the priority of the various work to be effected being determined in accordance with predetermined regulations. The priority or the precedence can be determined in dependence upon the time, external requirements and upon programmes and functions of variable conditions. The control system ensures that programmes are executed in accordance with these factors, the ending of programmes and conditions for breaks in programmes also being taken into consideration (see German Patent Specification 1 449 532, page 1, page 2, Claim 4, Claim 15). During this cooperation of parts of a data processing system, data traffic obviously takes place between the aforementioned parts of the data processing system. It is also already known that traffic and statistical considerations play an important role in the expedient structure and dimensioning of such devices in data processing systems. Therefore questions of this type have already been dealt with, although few concrete suggestions have yet been presented (see "Elektronische Rechenanlagen", 1970, pages 249 to 252).

The aforementioned parts of data processing systems may possibly be combined to form a plurality of complete data processing units which together form the data processing system (see "Elektronik 1969", page 217 to 219). The instructions which are received in a data processing system of this kind can be handled by batch processing, in which case the instructions are firstly accumulated and are subsequently processed. In contrast, in so-called real time processing, each instruction is processed immediately it occurs. In this case the instructions do not generally occur at regular intervals of time, but are statistically distributed, in accordance with probability theory. This must be taken into consideration in the designing of a real time data processing system, to avoid the response time being exceeded in the event of an accumulation of cases requiring processing (see Loebel, Mueller, Schmidt: Lexikon der Datenverarbeitung, 2nd Edition, page 418, 419, 482). A data processing system of this kind should, furthermore, be appropriately operated to enable the exploitation of the advantages which may be achieved. In these cases it is not sufficient to coordinate the cooperation of the parts of the data processing system with a control system which merely takes into consideration given priorities and precedences.

According to the present invention there is provided a data processing system including at least two independent programme-controlled real time data processing units, wherein instructions which are to be processed are normally conducted, in accordance with their varying natures, to a relevant one of the data processing units, wherein each data processing unit is constantly monitored to assess its load in terms of supplied instructions, wherein on the overshooting by a particular data processing unit of a given load limit value assigned to said unit, which limit lies below the point of

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overload of said unit, instructions which would otherwise have been supplied to said data processing unit are temporarily diverted to another data processing unit in which a given load limit value assigned to said other unit is not overshot, and wherein the diverted instructions are processed in said other data processing unit after a switch-over of programme has been carried out therein.

The term overloaded as used herein means that the data processing to which the term refers is loaded with so many instructions that it delays dealing with them for longer than a predetermined time, i.e. it no longer operates in real time.

The term excessively loaded means that the load on the data processing unit is above the predetermined limit but the input is still operating in real time.

The rerouting of the aforementioned instructions advantageously avoids an impermissible accumulation of cases awaiting processing in one and the same data processing unit. Thus the traffic is distributed amongst the associated data processing units more uniformly than usually. This advantageously also avoids traffic blocks, which themselves would give rise to disadvantageous effects. A traffic block would result in a delay of the access requests of a computer core and thus a reduction in the latter's efficiency. Furthermore, the waiting periods for the store access of an input/output unit would be able to be exceeded (see "Elektronische Rechenanlagen", 1970, page 249 to 250, pos. 2).

A process for operating centrally controlled exchange systems has in fact already been proposed in which central control devices are employed and in which the ratio of the number of control processes for the switch-through in the switching network, and the number of other control processes is constantly monitored. However, in this process the monitoring leads to a temporary limitation of specific operational possibilities (see German text laid open for public inspection 1 940 502). No such limitation exists in the system in accordance with the invention. Furthermore, the new system differs from the known in that the monitoring itself relates to different processes. Preferably the load which is measured is the ratio of the period of time during which a unit is seized by supplied instructions to the period of time during which said unit is free of such instructions.

As already stated, the system in accordance with the invention is provided, in particular, for the telephone exchange technique. It can, for example, be applied in an exchange system which contains an operational computer and an administrative computer to which are connected various operating desks for the handling of operational services. It can also, however, be applied e.g. to an exchange system which contains, as the data processing units, two markers with a switchable programme, which belong to an indirectly controlled exchange and which must execute specific control processes.

The present invention will now be explained by way of example and with reference to the drawings, in which:—

Figure 1 is a block circuit diagram of a data processing system in accordance with the invention;

Figure 2 is a block circuit diagram of two markers of a telephone exchange in accordance with the invention; and

Figure 3 is a block circuit diagram of an indirectly controlled exchange of which the markers shown in Figure 2, form component parts.

Prior to describing the above examples in detail, a few general comments should be made. However, the full meaning of the comments will not become apparent until they are considered in connection with specific examples. It is expedient, in a system in accordance with the invention having more than two data processing units, to divert instructions to that data processing unit which possesses the lightest load. For the diversion of instructions, peripheral devices acting as the sources of such instructions, can be disconnected from a highly loaded data processing unit and connected to a data processing unit which is not loaded to full capacity. It is most advantageous to commence by assigning the instructions in accordance with their nature, to the data processing units in such manner that the highest load of the various data processing units may be expected at different times. In this case it can be avoided, to a substantial extent, that all the data processing units of the system are simultaneously highly loaded. The temporary diversion of instructions normally assigned to a data processing unit is discontinued when the given load limit value assigned to that data processing unit has been undershot to a sufficient extent. It is also most advantageous to provide that different classes of the instructions are diverted in dependence upon the degree by which the given load limit value is exceeded. This can take place for example in that different types of instructions are diverted or that the diversion is effective in each case only for specific intervals of time. Additional instructions, which may be handled in batch processing, can be conducted to a data processing unit whose load lies substantially below the given load limit value.

The data processing system shown in Figure 1 comprises two data processing units B and R, to which are connected respective

load measuring devices Mb and Mr. The markers M11 and M12 of the exchange system shown in Figure 2 are likewise provided with measuring devices 11M and 12M. It should be realised that, in a telephone exchange system constructed in accordance with the proposals of the present invention, the markers thereof in fact form data processing units. The measuring devices Mb, Mr, 11M and 12M receive measuring signals from the associated data processing units or marker. For example the ratio of the time during which the unit is seized by supplied instructions (seizure time) to the time during which the unit is free of such instructions can be measured. This can be effected in that, during the seizure time, a measuring signal is transmitted to the relevant measuring device which device then itself transmits a measured value, with the cooperation of a time measuring device, which value corresponds to the extent of the load. To the measuring devices there is in each case connected a comparator device V1 or V2, which serves to compare the measured value of the load or each data processing unit with the given load limit value assigned to the respective data processing unit which lies below a point of overload. This load limit value is in each case supplied by a limit value generator G1 and G2, which is likewise in each case connected to the comparator device V1 or V2. In the system shown in Fig. 1, the given load limit value is the same for both of the data processing units B and R, so that limit value generator G1 supplies a common load limit value to the comparator device V1. In the system shown in Fig. 2, the given load limit values differ for the markers M11 and M12, so the generator G2 supplies different load limit value to the comparator device V2.

The comparator device V1, which forms a part of the data processing system shown in Figure 1, supplies the results of a comparison conducted between the given load, limit value and the measured values supplied by the measuring devices Mb and Mr. These comparison results indicate whether the load of the data processing units B and R lie above or below the given load limit value. Then, taking into account these comparison results, the data processing system to which instructions are to be diverted is determined by a seclector device A1, which is connected to the comparator device V1. For this purpose, the selector device A1 possesses a whole series of outputs. If the load of the data processing unit B exceeds the given load limit value, then at least one of the outputs ab1, ab2 and ab3 emits a control signal. If, on the other hand, the load of the data processing unit R exceeds the given load limit value, then at least one of the outputs ar1, ar2 and ar3 emits a control signal. Such control signals instigate the diversion of instructions, whereupon peripheral devices, which here serve as sources of instructions, are disconnected from the overloaded data processing unit and are connected to the non-overloaded data processing unit. Here the devices FEE, FEU, FEAD, AM, RE and S are provided as peripheral devices. Here they are each connected for the supply of said instruction to the two data processing units via respective switch-over devices Ua1, Ua2, Ua3, Ur1, Ur2 and Ur3. The routing of the instructions to the data processing units is effected by the switch-over devices, which are connected, to the selector device A1 to be controlled thereby, and, in fact, individually at its aforementioned outputs ab1 . . . ar3. If e.g. the load of the data processing unit B exceeds the given load limit value, but the load of the data processing unit R does not, however, exceed said load limit value, then the comparator device V1 supplies the selector device A1 with comparison results which result in said selector device A1 emitting a control signal via at least one of its outputs ab1, ab2 and ab3. This control signal passes to one of the switch-over devices Ua1, Ua2 and Ua3 and instigates the operation of said switch-over devices which results in the associated peripheral devices no longer being connected to the data processing unit B, but now to the data processing unit R. Consequently the load of the data processing unit B is reduced and that of the data processing unit R is increased. At the lowest of the various degrees of excess of the given load limit value a control signal is emitted only via e.g. the output ab1. Accordingly, then with the aid of the switch-over device Ua1, the peripheral devices FEE are then switched over from the data processing unit B to the data processing unit R. At a very high degree of excess of the given load limit value, on the other hand, control signals can be emitted e.g. via the two outputs ab1 and ab2, which results in the peripheral devices FEU being additionally switched over, via the switch-over device UA2 from the data processing unit B to the data processing unit R. A plurality of different degrees of excess of the given load limit value can accordingly be covered by in each case two control signals, emitted via various combinations of the outputs ab1, ab2 and ab3. Correspondingly, as has been described above, the peripheral devices AM, RE or S can be switched over from the data processing unit R to the data processing unit R, when control signals are emitted via at least one of the outputs av1, av2 and av3, which is the case when only the data processing unit R possesses a load which exceeds the given load, limit value. Expediently here, as in other cases of application, the given load

limit value is contrived to be such that after it has been exceeded, there still exists a certain margin for unobstructed operation of the data processing units.

If the data processing system illustrated in Figure 1 is supplemented by further data processing units, then the associated measuring devices must also be connected to the comparator device V1. The comparator device V1 consequently supplies more than two comparison values which must be conducted to the selector device A1. Then in order to determine the relevant data processing unit, the selector device A1 must take into consideration more than two comparison values in a selection process.

The aforementioned measuring devices 11M and 12M, which form a part of the exchange system illustrated in Figure 2, are connected to the comparator device V2. The limit value generator G2 supplies the aforementioned given load limit values for the loads of the data processing units. For example, if the given load limit value assigned to the data processing unit M11 is exceeded, any instructions which occur must be diverted to the data processing unit M12. However, this is only to take place when the load of the latter does not exceed the given load limit value assigned to this data processing unit, which e.g. is considerably lower than the given load limit value assigned to the data processing unit M11. Therefore here the comparator device V2 is set up in such fashion that it also takes into account the given load limit value for the load of the data processing unit M12 to which instructions may possibly have to be diverted. Therefore the limit value generator G2 supplies two different load limit values, that assigned to the data processing unit M12 being lower than that assigned to the data processing unit M11. The results of a comparison between the said load limit values and the measured values supplied by the measuring devices 11M and 12M are conducted to the selector device A2 which possibly subsequently instigates the diversion of instructions with the aid of a control signal which is transmitted from its output to the disconnection device U11 and to an OR element Y. The disconnection device U11 disconnects the supply of specific instructions which can otherwise pass to the marker M11. Via the OR element Y, the control signal is transmitted to the input *e* of the marker M12 whereupon the latter is caused to connect itself, with the aid of the contact *pv*12, to the line *v*, via which there now arrive instructions which are no longer being handled by the marker M11. The temporary diversion of instructions which has thus been effected, is discontinued when the load limit value provided for the marker M11 has been undershot to a sufficient extent. The interval of undershooting should be contrived to be such that too rapid a sequence of temporary diversions is avoided. This measure is also to be recommended in the case of the system shown in Figure 1. To match the varying degrees by which a given load limit value is exceeded, the diverted section of the instructions can here in each case be varied in that the diversion takes place in each case only for periods of time, separated by intervals, and in fact, e.g. with the aid of a pulse-shaped control signal. It is also possible to bring about the functions of the measuring devices and of the comparator devices with the aid of special programmes of the relevant data processing units. The special measuring devices and comparator devices are then not required. The diversion of instructions is then directly instigated by the relevant data processing units, when the latter can cooperate with one another, inter-changing data.

The above explanations of the operation of the data processing systems have related, in particular, to the measuring devices, comparator devices and selector devices provided both in the example shown in Figure 1 and also in the example shown in Figure 2. In both cases, having been diverted, the instructions are processed in the relevant data processing unit, after a switch-over of programme. Here for example the fact that the diverted instructions in each case arrive via different inputs to the non-diverted instructions is exploited for the triggering of a programme switch-over. Thus, in the data processing unit R of the data processing system shown in Figure 1, the diverted instructions arrive via inputs which are connected to the switch-over device Ua1, Ua2 and Ua3, whilst non-diverted instructions arrive via inputs which are connected to the switch-over devices Ur1, Ur2 and Ur3. In the marker M12 of the exchange system shown in Figure 2, diverted instructions arrive via the contact *pv*12 which lies at one input, whilst non-diverted instructions arrive via the contact *pw*12 which lies at another input.

Now further details will be given of the special nature of the data processing systems illustrated in Figures 1 and 2, and supplementary measures for the development of the systems will also be discussed.

The data processing system shown in Figure 1 is intended for use in the telephone exchange technique. Here the data processing unit B represents a so-called operational computer. An operational computer of this kind serves to support the work which occurs in central maintenance stations for the telephone exchange operation (see "Informationen Fernsprech-Vermittlungstechnik" 1970, page 8 and page 10). This covers data which occur in a debugging station, a main-

tenance service station and a telephone order service station. One of the items which this computer can store are the relevant data for documentation and statistics which it emits via data viewing equipment and page printers and, at the same time, interprets and classifies in respect of urgency. Store interrogation processes can also be effectively supported by an operational computer of this kind. (See also our copending Patent Application 36466/72) (Serial No. 1391084). Accordingly, for the handling of operational services, the following operating desks or positions are connected to the operational computer B: Operating desks positions FEE for the debugging station, FEU for the maintenance service station and operating desk FEAD for the telephone order service station. Into the lines leading from these operating desks to the operational computer B are interposed the aforementioned switch-over devices Ua1, Ua2 and Ua3, with the aid of which instructions arising from said operating desks can also possibly be diverted to the data processing unit R. Here the data processing unit R is used as an administrative computer. The following operating desks are connected thereto for the handling of operational services: operating desks AM for the application station, operating desks RE for the calculating station and other operating desks S. Aforementioned switch-over devices, namely the switch-over device Ur1, Ur2 and Ur3 are also connected into those lines via which these operating desks are connected to the administrative computer. Through the actuation of said switch-over devices, instructions can be diverted to the operational computer B.

The operative range of a debugging station includes an intereference card index, operation of test and conrol desks, and the like. The operative range of the maintenance service station includes the monitoring of devices, modification of subscriber and operational data, the starting of test programme sequences, determination of wiring data of distributors and the like. In a telephone order service station, orders for special services for subscribers are received, and the execution thereof is instigated. The operational computer allows telephone order services to be handled automatically. In the application station, new applications and modifications in subscriber terminals are processed, whereby the aforementioned lines, distributors and the like must be taken into consideration. This information is contained in the data store of the administrative computer. The administrative computer can also cooperate in further operational processes. For this purpose, are provided therein, the other operating desks marked "S". The data processing units B and R cooperate in the handling of all these operational processes, by means of data supply and data processing. It is expedient to draw on the assistance of data viewing devices. In this case the relevant data processing unit cooperates in the procesing in that it emits the requisite data via a data viewing device, and, in the course of a dialogue traffic, emits data which it has processed via devices which have been determined as a result of the present instruction. The operating desks RE of a calculating station are also connected to the administrative computer R. For example, the individual and collective interrogations of charge states are handled through these desks. The distribution of all these operative desks amongst the two data processing units B and R can result in the fact that data exchange is necessary between the operational computer and the administrative computer, whereupon they copperate in known manner. The connection lines L serve for this cooperation. Data and programmes can also be transmitted via these lines, when this becomes necessary in the case of diversion of instructions. Therefore it is advantageous for the data processing units B and R to be adjacent to one another. If the known technique of simultaneous operation of data processing units (see "Elektronische Rechenanlagen", 1960, page 117 to 128) is applied, then a disturbing overload of the particular other data processing unit can be substantially avoided.

Here the operating desks are distributed between the two data processing units B and R under the principle of enabling the particular highest load of the data processing units to be expected at different times. Those operative stations which are subject to time pressure are connected to the operational computer B. The operational processes to be handled therein emanate from telephone subscribers upon whom the telephone administration can exert no influence to uniformly distribute their instructions over the available time. Furthermore, the instructions which arise must be handled as rapidly as possible. On the other hand, those instructions which arise for operative services which involve the cooperation of the administrative computer R, generally emanate from employees of the telephone administrative authorities. Therefore it can be arranged that these instructions be distributed, in a specific fashion, over the time available. In can thus be arranged that the highest load of the administrative computer is to be expected at a different time to that of the operational computer B. The overall situation is that the operational computer is obliged to operate in real time operation, but the operation of the administrative computer on the other hand possesses certain similarities to batch operation in respect of its use by the per-

sonnel. Thus in a particularly advantageous manner it is in fact also actually possible to divert instructions in accordance with the present invention. I.e., a particularly low load of the administrative computer can be provided whenever the highest load of the operational computer is to be expected, so that instructions can then be diverted from the operational computer B to the administrative computer R. On the other hand, during particularly low load periods, the operational computer B can be supplied with instructions which would otherwise be executed by the administrative computer R.

As mentioned previously, the exchange system illustrated in Figure 2 includes two associated markers M11 and M12 which act as data processing units, must execute control processes, for the handling of connection applications for a switching network. Here different control processes for the same connection may be handled consecutively in time and control processes for different connections may be handled simultaneously. The markers are connected, in accordance with Figure 2, in such manner that they handle different control processes. This is due to the operative position of the associated contacts. For example, in the marker M11 the contact *pv*11 is closed whereas the contact *pw* 11 is open, and vice versa in the marker M12 the contact *pv*12 is open whereas the contact *pw*12 is closed. Applications for the operation of these markers take place via these contacts. For this purpose, said contacts are connected to the application lines *w* and *v*. An instruction for the one control process arrives via the application line *w*, and an instruction for the other control process arrives via the application line *v*. It is the operative position of the associated contacts which determines which control processes the markers will execute. For example, a marker only effects on instruction when the contact via which it is connected to the associated connection line is closed. When both the contacts are closed in a marker, it can be operated to execute both control processes. Each marker possesses an associated store. The store Q11 belongs to marker M11 and the store Q12 belongs to marker M12. Each marker is set up in such manner that it operates in accordance with one of the programmes input into its store. A programme switch-over can e.g. be effected by means of signals which also influence the stores.

By way of temporary assistance, the marker M12 can execute both those control processes which it is assigned from the start, and also those control processes which would otherwise be executed only by the marker M11. Here this is the case when the marker M11 would otherwise be subjected to an overload. In the event of the complete breakdown of a marker, the particular other marker can even assume all the control processes, as long as it is not overloaded. Data processed by the markers are transmitted, from their transmitting outputs *s*, via the central data busbar D, from where the markers can also be supplied with specific data. For example, via this data busbar, the markers can also be supplied with application signals which are received at their particular receiver input *e* and analysed. They can also be used for switch-over to the requested control process. This enables the application signal supplied by the selector device A2 to be passed on via the OR element Y to the input *e* of the marker M12.

The markers M11 and M12 form part of a telephone exchange system, the basic structure of which is already known (see German Patent Specification 1 912 192). The basic structure of an exchange of this kind is shown in Figure 3, in which, in addition to the markers M11 and M12, the markers M21 . . . M32 are also provided. The associated switching network consists of a plurality of subsidiary switching networks TKF1, TKF2 and TKF3, each of which is assigned a pair of markers. Thus the subsidiary switching network TKF1 is connected to the markers M11 and M12. Each subsidiary switching network comprises a plurality of switching stages. The subsidiary switching networks are interrelated in that in part their outputs are connected in parallel, namely in the case of the subsidiary switching networks TKF1 and TKF2, in a manner known per se, and in that return overflow devices *rk*, known per se, are provided between the subsidiary switching networks TKF3 and TKF2. Data to be conducted to the markers, which will possibly also include the aforementioned application signals which are specific to the control processes, together with data processed by the markers are transmitted via the duplicated busbar Da-Db to which the markers are connected. The markers are applied for by the devices S1 and S2, for which purpose the application lines sum are provided. Here the devices S1 and S2 represent control sets which cooperate in the handling of instructions for control processes. The two allocator devices 1U and 2U are also provided, which likewise cooperate.

A description of the special nature of the various control processes will now follow. Thus the marker M11 can in each case execute a control process, as a preliminary test-marker to establish whether there is at least one free line, in a line group emanating from the switching network or subsidiary switching network which has been predetermined by a connection application

and the like. In this connection, the marker M12 can then execute a control process as path marker, when free connection paths are hunted in the switching network or subsidiary switching network, one thereof is selected and switched through. In this case a connection application is handled in the following manner. Via the application line *v*, the markers M11 and M12 are firstly supplied with an instruction for the control process for the preliminary check function. The marker M11 carries out this control process and the necessary and processed data are exchanged via the data busbar D and Da-Db with other devices. At the same time the marker M12 can also deal with an instruction for the other control process, namely for path hunting, selection and switch-through. This control process is handled for a different connection than the previous control process. Thus here control processes for different connections are handled simultaneously. It must subsequently be expected that the marker M12 will have to operate, once more, as path marker and, in fact, in order to handle a control process for the particular one of the two aforementioned connections for which this control process has not yet been effected. As has already been described, in particular the marker M12 can also itself handle the various control processes consecutively.

When particularly heavy telephone traffic prevails, e.g. during the so-called busy period, it will mainly be expected that the preliminary check marker M11 will not find a free line, at least on the first check. If several groups of lines exist, which must be separately checked, then the marker must repeat the control process required for the checking once or several times. Even then it may be that it will not find a free line. Under these conditions it can occur that on average to one control process to be executed by the path marker M12, there are apportioned a plurality of control processes which must be executed by the preliminary testing marker M11. Without special measures, this can then result in the preliminary testing marker becoming overloaded. The invention provides a remedy in this respect, in which, when a given load limit value lying below an overload point is exceeded, the path marker M12 is also used for the preliminary testing function. For this purpose, in the manner described above, a part of the instructions for the preliminary testing marker M11 are diverted to the path hunting marker M12 which processes the diverted instructions after the programme has been switched over.

WHAT WE CLAIM IS:—

1. A data processing system including at least two independent programme controlled real time data processing units, wherein instructions which are to be processed are normally conducted, in accordance with their varying natures, to a relevant one of the data processing units, wherein each data processing unit is constantly monitored to assess its load in terms of supplied instructions, wherein on the overshooting by a particular data processing unit of a given load limit value assigned to said unit, which limit lies below the point of overload of said unit, instructions which would otherwise have been supplied to said data processing unit are temporarily diverted to another data processing unit in which a given load limit value assigned to said other unit is not overshot, and wherein the diverted instructions are processed in said other data processing unit after a switch-over of programme has been carried out therein.

2. A system as claimed in Claim 1, wherein the load which is measured is the ratio of the period of time during which a unit is seized by supplied instructions to the period of time during which said unit is free of such instructions.

3. A system as claimed in Claim 1 or Claim 2, wherein more than two data processing units are provided, and wherein instructions are diverted to the data processing unit which possesses the lightest load.

4. A system as claimed in any one of the preceding Claims, wherein, to divert instructions, peripheral devices acting as sources of such instructions are disconnected from the excessively loaded data processing unit and connected to a data processing unit which is not loaded to full capacity.

5. A system as claimed in any one of the preceding Claims, wherein the instructions are normally assigned, in accordance with their individual natures, to the data processing units in such manner that the highest loads on different data processing units may be expected at different times.

6. A system as claimed in any one of the preceding Claims, wherein the temporary diversion of instructions normally assigned to a data processing unit is discontinued when the given load limit value assigned to that data processing unit has been undershot by a predetermined extent.

7. A system as claimed in any one of the preceding Claims, wherein different classes of instructions are diverted, in dependence upon the degree by which the given load limit value is exceeded.

8. A system as claimed in any one of the preceding Claims, wherein additional instructions which may be handled by batch processing are conducted to a data processing unit whose load lies substantially below the given load limit value assigned to that data processing unit.

9. A system as claimed in any one of the preceding Claims, wherein the load on

each data processing unit is measured by a respective measuring device, wherein a comparator device, which serves to compare the measured value of the load on each data processing unit with the given load limit value assigned to the respective data processing unit is connected to the measuring devices, and wherein to the comparator device there is connected a selector device which, taking into account the comparison results, controls the routing of instructions to the data processing units.

10. A system as claimed in Claim 9, wherein peripheral devices acting as sources of instructions, are each connected for the supply of said instructions via a respective switch-over device to a plurality of the data processing units, and wherein said routing of the instructions to the data processing units is effected by the switch-over devices which are connected to the selector device to be controlled thereby.

11. A system as claimed in Claim 9 or Claim 10, utilised as a telephone exchange system, wherein the data processing units include an operational computer and an administrative computer, wherein to the operational computer there are connected an operating desk of a debugging station, an operating desk of a maintenance service station, and an operating desk of a telephone instruction service station, and wherein to the administrative computer there are connected an operating desk of an application station, and an operating desk of a calculating station.

12. A system as claimed in Claim 11, wherein devices are provided for the interchange of data between the operational computer and the administrative computer.

13. A system as claimed in Claim 9 or Claim 10, wherein the comparator device is set up in such manner that it takes into account the given load limit value assigned to the data processing unit to which instructions are to be diverted.

14. A system as claimed in any one of Claims 9, 10 or 13, comprising an indirectly controlled telephone exchange system wherein each of the data processing units is constituted by a respective marker, which markers execute control processes for the handling of connection applications within a switching network, and wherein different control processes for the same connection are handled consecutively and control processes for different connections are handled simultaneously.

15. A data processing system substantially as herein described with reference to the drawings.

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1398651 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig.1

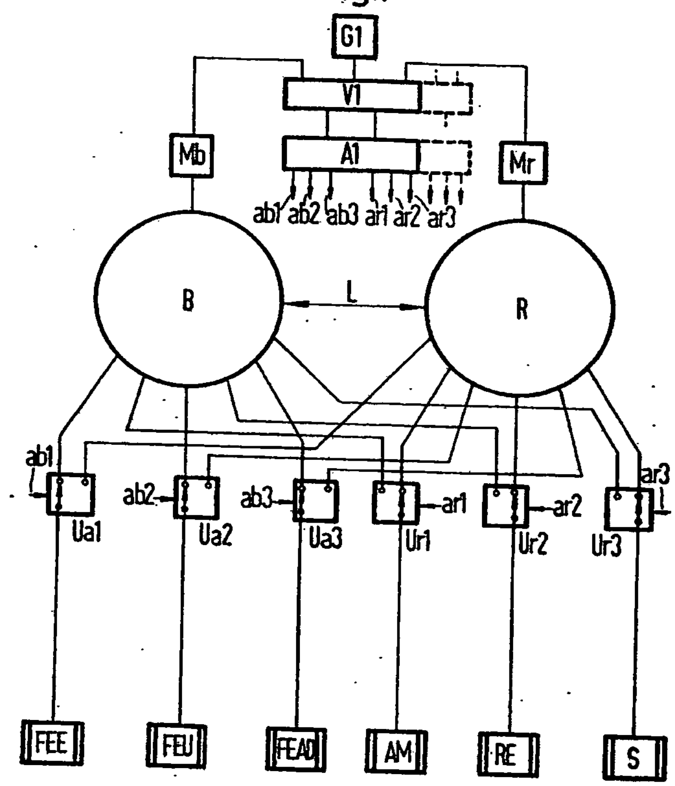

Fig.3